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NASA Procedural Requirements

COMPLIANCE IS MANDATORY**NPR 7120.8**Effective Date: February 05,
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Request Notification of Change

 (NASA Only)

Subject: NASA Research and Technology Program and Project Management Requirements

Responsible Office: Office of the Chief Engineer

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Appendix K. Research and Technology Project Work Breakdown Structure (WBS)

1.0 Introduction

1.1 The Project Work Breakdown Structure (WBS) is a key element of project management. The purpose of a WBS is to divide the project into manageable pieces of work to facilitate planning and control of cost, schedule, and technical content. Research and Technology (R&T) projects are either Technology Development Projects (formerly referred to as Advanced Technology Development (ATD)) or R&T Portfolio Projects (formerly referred to as Basic and Applied Research Portfolio (BAR)).

2.0 Assumptions

2.1 The WBS standard elements defined in this appendix are only applicable to R&T projects.

3.0 Project Business Rules

3.1 Purpose: The standardization of WBS elements for R&T projects is being driven by requirements for more effective cost estimating and consistency of project work packages across the Agency. WBS elements only apply to projects, not programs.

3.2 Business Rules:

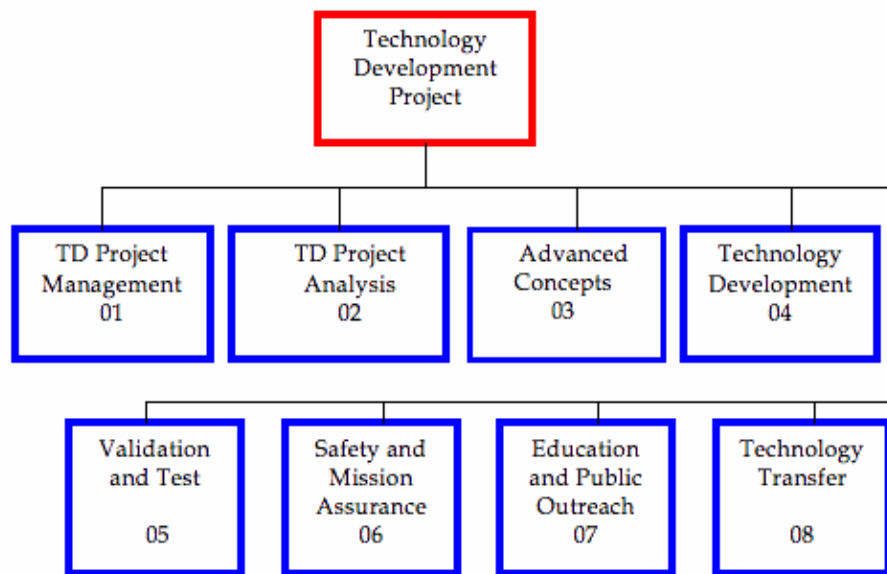
- a. The standard R&T project WBS applies to new projects established from the issue date for NPR 7120.8. It is not intended to be applied retroactively to existing projects.
- b. The standard R&T project WBS applies to the entire life cycle of the project.
- c. R&T projects will use the standard Level 1/2 WBS elements (see section I.4 and I.5). Specifically:
 - (1) The project name will be WBS Level 1 (corresponds to Agency Project 6 digit alpha numeric designators).
 - (2) The title of each WBS Level 2 element can be modified to facilitate project-unique titles, such as adding the name of the project in front of the title. However, the content and definition of each WBS element remain the same and if the linkage of the project-unique title to the standard title is not intuitive, the project-unique title is cross-referenced to the standard.
 - (3) If the set of standard WBS Level 2 elements does not comprise an exhaustive set of WBS elements, additional WBS elements may be added horizontally (i.e., at Level 2) as long as their content does not fit into the content of any existing standard WBS elements.

- (4) For each standard WBS Level 2 element and the subordinate WBS elements at Level 3 and lower, Project Leads should work in coordination with the OCFO to ensure there is visibility to which elements within the structure will result in the fabrication and/or acquisition of a capital asset.
- (5) The WBS Level 3 and lower elements are established by the projects and can differ from project to project, but will include only work that rolls up to the standard WBS Dictionary definition of the Level 2 element.
- (6) If there is no work to fit into a standard WBS element, then an inactive placeholder element (and an inactive placeholder financial code) will be established.
- (7) The financial WBS will align with the technical WBS.
- (8) The management assigned to each WBS element may differ from project to project.

4.0 Technology Development (TD) Project (formerly Advanced Technology Development Project)

4.1 Technology Development Project WBS (formerly Advanced Technology Development Project WBS)

Standard Level 2 WBS elements for TD projects are shown in Figure I-1. The standard WBS template below assumes a typical TD project with no flight elements. For TD projects, additional WBS elements may be added horizontally (i.e., at Level 2) as long as their content does not fit into the content of any existing standard WBS elements. The elements that are not applicable do not need to be used (entered into MdM). For TD projects managed in accordance with NPR 7120.5, NASA Space Flight Program and Project Management Requirements, the Space Flight Project WBS will be used.



**Figure K-1 TD Project WBS
(formerly Advanced Technology Development WBS)**

4.2 TD Project Standard WBS Dictionary (formerly Advanced Technology Development Project Standard WBS Dictionary)

Element 1 -- TD Project Management: The business and administrative planning, organizing, directing, coordinating, controlling, and approval processes used to accomplish overall project objectives, which are not associated with specific hardware or software elements. This element includes project reviews and documentation, non-project owned facilities, and project reserves. It excludes costs associated with technical planning and management and costs associated with delivering specific engineering, hardware, and software products.

Element 2 -- TD Project Analysis: System and Portfolio Analysis includes the process of developing qualitative and quantitative understanding of key technical issues and drivers, including current limitations and challenges. These analyses are the foundations that support development and assessment of: goals, requirements, scope, risk/feasibilities, costs, design, integration, and operations. Based on the systems analysis, the process further identifies and tracks the investment trade spaces and supports the project's ability to optimize its resources to

maximize the return on investment within acceptable risk exposure, budget, schedule, and performance requirements.

Element 3 -- Advanced Concepts: This WBS element encompasses low-level studies (possibly including laboratory experiments) intended to explore the feasibility of new ideas or approaches to accomplish programmatic or technical objectives. Often they are inspired by new scientific or technical breakthroughs that open up new avenues for technological investigation. Advanced concept activities can be an integral part of a specific technology project, or they can be separate technology activities focused on broad topics. Typically, advanced concept activities are tied to long-term objects, though this is not required, and due to their speculative nature, are generally considered high-risk. Also, they tend to be managed in a looser manner than technology development. Advanced concept studies are a principal means for identifying promising new opportunities for high payoff technology development.

Element 4 -- Technology Development: This WBS element encompasses the execution phase of implementing a TD project plan. Typically, most of the lower level (Level 3 and below) WBS elements associated with achieving the technical objectives (e.g., performance metrics) of the project are contained within this element. TD projects span the gap from advanced concepts to engineering or advanced development (TRL 2/3 to TRL 6/7) and can begin and end anywhere within this range. As such, it can be driven by specific requirements or more general objectives. Once a project has started, technology development will include the continual assessment of progress, redistribution of resources and schedule updates necessary to meet key milestones within the planned budget and time frame. When the intended outcome cannot be met within plan, the function of re-planning at the project level falls within Project Management. The primary project deliverables, including technical progress reports and documenting technical accomplishments, are part of this WBS element.

Element 5 -- Validation and Test: This element provides for a focus on specific activities to test and validate products of technology development when those activities represent a critical aspect of the overall technology development plan. Not all technology projects require this level of attention on test and validation. Typically, a separate test and validation element will be part of the project that intends to achieve TRL 6/7. The element encompasses the development hardware/software test validation articles; development or acquisition of special test or validation equipment or procedures; scheduling and staffing facilities or ranges; as well as the development and execution of the test or validation plan. Often the full context and content of test and validation may not be known at the beginning of the project and will be developed as required. In some cases, if extensive use of large-scale facilities is required or the test/validation takes on the characteristics of a flight project (e.g., space-flight project), it will be conducted as a flight project (e.g., space-flight project) within this WBS element or transferred to a space flight project in accordance with NPR 7120.5, NASA Space Flight Program and Project Management Requirements.

Element 6 -- Safety and Mission Assurance: The technical and management efforts of directing and controlling the safety and mission assurance elements of the project. This element includes design, development, review, and verification of practices and procedures and success criteria intended to assure that the delivered product meets performance requirements and function for their intended lifetimes. This element excludes mission and product assurance efforts at partners/subcontractors other than a review/oversight function.

Element 7 -- Education and Public Outreach: Provide for the education and public outreach (EPO) responsibilities of NASA's missions, projects, and programs in alignment with the Strategic Plan for Education, including management and coordinated activities, formal education, informal education, public outreach, media support, and Web site development.

Element 8 -- Technology Transfer: This WBS focuses principally on three types of activities:

(1) transferring knowledge and technology development products developed within the project to non-NASA entities that are not part of the project either as direct participants or as direct beneficiaries of the project, (2) acting on behalf of the project to identify and transfer into the project knowledge or technology from sources not directly participating in the project or benefiting from the project, and (3) providing supporting expertise to transfer knowledge and technology products between NASA and non-NASA entities, including project participants. Typically, technology transfer requires special expertise not associated with any specific project or required to accomplish primary technical objectives/milestones/metrics. Also, technology transfer activities are often an integral part of the overall project plan but not necessarily an integral part of the technology development process. As such, it is often appropriate to fund, implement, and manage technology transfer as a distinct element of a TD project.

5.0 R&T Portfolio Project (formerly Basic and Applied Research Portfolio)

5.1 R&T Portfolio Project WBS (formerly Basic and Applied Research Portfolio WBS)

Standard Level 2 WBS elements for R&T Portfolio Projects are shown in Figure I-2. The template is used to specify the integrated budget within the R&T Portfolio Project Plan. For R&T Portfolio Projects, additional WBS elements may be added horizontally (i.e., at Level 2) as long as their content does not fit into the content of any existing

standard WBS elements. The elements that are not applicable do not need to be used. For R&T Portfolio Projects managed in accordance with NPR 7120.5, NASA Space Flight Program and Project Management Requirements, the Space Flight Systems Project WBS will be used.

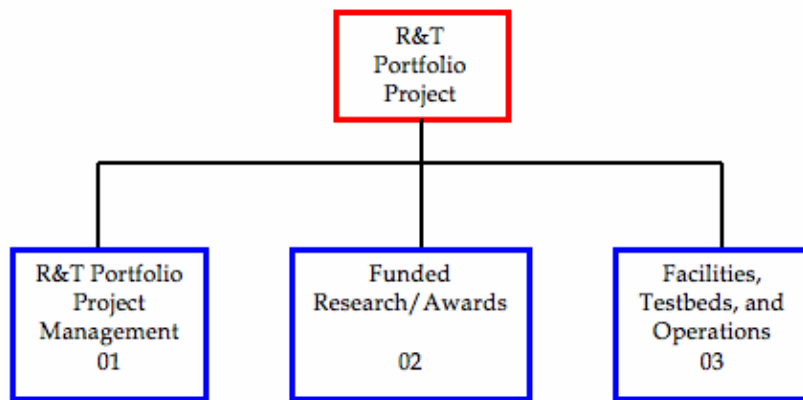


Figure K-2 R&T Portfolio Project WBS
(formerly Basic and Applied Research Portfolio WBS)

5.2 R&T Portfolio Project Standard WBS Dictionary (formerly Basic and Applied Research Portfolio Standard WBS Dictionary)

Element 1 -- R&T Portfolio Project Management: The management activity is paid for with R&T Portfolio Project dollars. This includes salaries and travel (e.g., civil service personnel, Intergovernmental Personnel Act assignees, detailees), peer review management (contractor support, travel, and honoraria), and meetings and conferences.

Element 2 -- Funded Research/Awards: The awards from either competed or directed elements of the R&T Portfolio Project. This includes but is not limited to grants, Independent Assessment Teams, Research and Technology Objectives and Plans Summaries (RTOPs), and contracts. This element may also include awards for Education and Public Outreach.

Element 3 -- Facilities, Testbeds, and Operations: The non-award infrastructure costs that support the R&T Portfolio Projects.

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